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(54) IMPROVEMENTS IN OR RELATING TO BUILDING COMPONENTS

(71) We, INCENTIVE AB, a Swedish Company, of Arsenalsgatan 4, 111 47 Stockholm, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to incombustible, water-resistant and frost-resistant slabs for building purposes. Its primary object is to provide building slabs which may be employed for the same purposes as hitherto known wood-fibre boards, wood-chip boards, plaster boards and the like. In addition, however, it is proposed to provide a slab-form building element which can be produced with considerably larger dimensions, so that it may be employed as a wall element both for inside walls and for outside walls. Neither the known wood-fibre and wood-wool boards nor the known plaster boards are water-resistant or frost-resistant. Wood-fibre or wood-chip boards are also combustible, while plaster boards have relatively low bending strength.

The object of the invention is therefore to provide a building slab which is both incombustible and water-and frost-resistant, and which exhibits high bending strength and nevertheless has relatively low weight.

According to the invention there is provided a slab-form building element, comprising a core consisting of foamed concrete or foamed plaster and with a reinforcement consisting of an incombustible inorganic fibrous material; and on each side of this core a thin layer of randomly oriented glass fibres bonded to each other by means of a binding agent, said bonded glass fibre layer being at least partially impregnated with the foamed concrete or foamed plaster respectively of said core, and outermost a coating of a synthetic plastics material.

The central core of the building element preferably consists of foamed concrete or foamed plaster which is reinforced with an incombustible inorganic fibrous material such as mineral wool or asbestos, for example, and contains an addition of one or more synthetic water-insoluble polymers such as, for example, polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyacrylate, epoxy resin, polyester resin, polystyrene-butadiene or copolymers of these materials which are capable of binding the mineral fibres and of increasing the tensile strength of the concrete or of the plaster.

The layers of fibre-reinforced impervious binder situated on both sides of the core preferably consist of unfoamed cement or plaster with an addition of a synthetic water-insoluble polymer such as, for example, polyvinyl acetate, polyvinyl chloride or polyvinylidene chloride, which is capable of binding the fibre reinforcement and of increasing the tensile strength of the cement or plaster. The fibre reinforcement may consist of short fibres aligned in any manner or of a fibrous fabric. Suitable fibrous materials are, for example, jute, diabase, asbestos or glass fibres. Preferably, the fibre reinforcement in this impervious cement or plaster layer reinforced with synthetic polymer also extends into the outer plastics layer, so that the latter is also fibre-reinforced. The outermost plastics layer may with advantage

consist of polyethylene, urea resin, melamine resin, epoxy resin or polyester resin.

Alternatively, the fibre-reinforced impervious binder layers situated on both sides of the central core may be fibre-reinforced plastics layers consisting of the same plastics as the outermost plastics layers. In this case, the fibre reinforcement in these fibre-reinforced plastics layers preferably also extends somewhat into the central core.

The central, mainly porous core of the slab-form building element according to the invention imparts the necessary rigidity and compressive strength to the element. The fibre-reinforced impervious binder layers situated on both sides of the core impart the desired high bending strength to the building element and render the porous core impervious to water. The outermost plastics layers of the building elements render the element completely waterproof and moisture-proof. These plastics layers also impart to the element a weather-proof surface of attractive appearance which requires no maintenance. These plastics layers may be coloured in a manner known per se, so that the element acquires the desired colour. It is also possible to mix mineral grains or the like in the outermost plastics layers in order to obtain particular aesthetic effects.

Due to the aforesaid choice of materials in the various parts of the building element according to the invention, the element is obviously made incombustible. Since the central core, which makes up the greater part of the building element, is predominantly porous, the building element is also of relatively low weight and has relatively good heat-insulating and sound-insulating properties.

For a better understanding of the invention, a number of examples of the production of an element according to the invention will be more particularly described with reference to the drawings, in which:

Figure 1 is a diagrammatic cross-sectional view of a first form of construction of a building element according to the invention, and

Figure 2 is a similar view of another form of construction.

The slab-form building element according to the invention as diagrammatically illustrated in cross-section in Figure 1 comprises a central core 1 forming the greater part of the thickness of the building element. This core is for the greater part porous and held together by a hydraulic binder such as, for example, cement or plaster. The core 1 preferably consists of foamed cement or foamed plaster having a reinforcement consisting of mineral fibres and an addition of synthetic water-insoluble polymer which binds the fibre reinforcement and increases the tensile strength of the cement or plaster. The core may also consist of a filler held together by cement or plaster and consisting of grains or globules of expanded calcined clay. For thin slabs which are to serve the same purpose as the known wood-fibre boards, plaster boards and similar building slabs, the core 1 may have a thickness of, for example, 5—20 mm. In the case of thicker building elements which may be employed as wall elements, the core 1 may have a thickness of, for example, 50—200 mm. Situated on either side of the central core 1 are impervious fibre-reinforced layers 2 of cement or plaster with an addition of a synthetic water-insoluble polymer which is capable of binding the fibre reinforcement and of increasing the tensile strength of the cement or plaster. The fibre reinforcement may consist of short fibres having any orientation, for example of diabase, glass wool, asbestos or the like, or of a fabric consisting of fibrous material, for example jute fabric or glass fibre fabric. These impervious fibre-reinforced cement or plaster layers reinforced with polymeric material may have a thickness of, for example, 1—10 mm., depending upon the total thickness of the building element.

Situated outermost are two thin plastics layers 3, for example of polyethylene, urea resin, melamine resin, epoxy resin or a polyester resin. These plastics layers may be completely unreinforced or the fibre reinforcement in the inner fibre-reinforced impervious cement or plaster layers 2 may also extend into the outermost plastics layers 3, so that the latter are also partially fibre-reinforced. The outermost plastics layers 3 may be coloured in a manner known per se or they may contain mineral grains, so that the surface of the building element is given the desired appearance. These outermost plastics layers 3 may have a thickness of, for example, 0.1—3 mm., depending on whether they are fibre-reinforced or not.

The building element according to the invention which is correspondingly diagrammatically illustrated in Figure 2 comprises a central core 1 of the same type as the building element illustrated in Figure 1. This core 1 is surrounded on both sides by fibre-reinforced plastics layers 4 whose fibre reinforcement preferably extends somewhat into the core 1 and which thus form both impervious fibre-reinforced binder layers corresponding to the layers 2 in the building element according to Figure 1 and outer plastics layers on the surfaces of the building element corresponding to the plastics layers 3 of the building element according to Figure 1.

A building element of the construction illustrated in Figure 1 may be produced, for example, in the following manner:

1. There is applied to a mould or another suitable substrate a thin layer of fibres having any desired orientation which are either free or somewhat bound together, for example diabase, glass wool or asbestos fibres, or a fabric, for example a jute fabric or a glass fibre fabric.

The weight per unit area of this fibre layer is, for example, 100 to 200 g/m².

2. There is poured on to this fibre layer a cement or plaster mass which contains an aqueous emulsion of a synthetic water-insoluble polymer such as, for example, polyvinyl acetate, polyvinyl chloride or polyvinylidene chloride which is capable of binding the fibres and of increasing the tensile strength of the plaster or cement mixture. For example, a cement mass may be employed which consists of 74% by weight of cement, 24% by weight of water and 2% by weight of polyvinyl acetate emulsion (about 50% dry substance).

3. The mould or substrate is shaken, so that the cement or plaster mass penetrates into the fibre layer.

4. There is poured on to the fibre-reinforced impervious cement or plaster layer according to Point 3 a mass forming the core of the building element and consisting of foamed concrete or foamed plaster, which contains a fibre reinforcement and an addition of synthetic water-insoluble polymer. This foamed concrete mass or foamed plaster mass is preferably produced by vigorously stirring an aqueous emulsion of a synthetic water-insoluble polymer or a mixture of such polymers, for example polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyacrylates, epoxy resin, a polyester resin or polystyrene-butadiene containing about 1—10%, preferably 2—6%, by weight of polymer and about 1% by weight of a wetting agent, for example sodium alkyl sulphonate, and optionally a foam-stabilising substance, for example carboxymethylcellulose, so that a stable water-polymer-foam is produced. In this foam, or in the production of the foam, about 2—20% by weight of mineral fibres, for example mineral wool or asbestos, are dispersed. With relatively low stirring, cement or plaster is added to give a final water-cement number or water-plaster number of preferably about 0.5—0.6 or possibly less, depending upon the density aimed at.

Instead of such a mass consisting of foamed concrete or foamed plaster, there may be employed for the core a mixture of cement or plaster, water and a filler consisting of grains or globules of expanded calcined clay, so that the core of the building element consists of a filler of expanded calcined clay bound by cement or plaster.

5. On to the layer according to Point 4 is poured a thinner layer of cement or plaster, water and synthetic polymer according to Point 2.

6. A thin mat of mineral or glass fibres of any desired orientation, somewhat bound together, or a jute fabric or glass fibre fabric is applied to the layer according to Point 5 and preferably forced into the layer. Alternatively, the step according to Point 5 may be omitted, in which case the fibre mat or the fibre fabric is alternatively first impregnated with a cement or plaster mass according to Point 2.

7. The slab-form or plate-form element produced in the desired manner is preferably hardened at a temperature of about 50—70°C.

8. After the hardening of the hydraulic binder in the building element and evaporation of the surplus water, the two surfaces of the element are coated or impregnated with a plastics which is optionally coloured or mixed with mineral grains. This may be done by spreading or spraying the plastics in dissolved form on to the two surfaces of the element. For this treatment, for example, carbamide clear lacquer containing aluminium-chromium orthophosphate as hardener, epoxy lacquer or a mixture of polyester resin (70%) and polystyrene (30%) and a hardener may be employed. The plastics, especially when melamine is employed, may be applied to the two surfaces of the element in the form of a fine powder, which is thereafter melted to form a plastics layer by passing the element between warm rolls. Alternatively, the partially fibre-reinforced outermost plastics layers may be produced on the two surfaces of the building element by introducing a thin layer of mineral or glass fibres between two polyethylene foils. An endless web of layers thus arranged is passed between heated rolls, whereby the fibre layer is bound in the two polyethylene layers situated on either side. Thereafter the polyethylene foils are pulled apart, whereby there are obtained two polyethylene foils having fibres adhering to one side. These polyethylene foils having a fibrous layer on one side may be employed instead of the fibre layers mentioned in Points 1 and 6 in the foregoing. In this case, therefore, it is not necessary to apply any outer plastics layers to the surfaces of the element after the latter has been produced.

A building element according to Figure 2 may in principle be produced in the described manner, but in this case the impervious cement or plaster layers containing synthetic polymer according to Points 2 and 5 are omitted. Instead, the outer plastics layers are produced with a greater thickness and it is ensured that they are reinforced with a fibre reinforcement which preferably also extends somewhat into the core of the building element.

WHAT WE CLAIM IS:—

1. A slab-form building element, comprising a core consisting of foamed concrete or foamed plaster and with a reinforcement consisting of an incombustible inorganic fibrous material; and on each side of this core a thin layer of randomly oriented glass fibres bonded on each other by means of a binding agent, said bonded glass fibre layer being at least partially impregnated with the foamed concrete or foamed plaster respectively of said core, and outermost a coating of a synthetic plastics material.

2. A building element as claimed in claim

1, wherein said foamed concrete or foamed plaster of said core contains, in addition to one or more of said synthetic water-insoluble polymers, such as for example polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyacrylate, epoxy resin, polyester resin, polystyrene-butadiene or copolymers of these materials.

3. A building element as claimed in claim 2, wherein said core contains about 1—10% by weight of fibrous material and about 0.5—5% by weight of polymeric material, calculated on the quantity of cement or plaster.

4. A building element as claimed in any preceding claim, wherein said binding agent is cement or plaster.

5. A building element as claimed in claim 4, wherein said binding agent consists of cement or plaster containing a synthetic water-insoluble polymer, such as for instance polyvinyl acetate, polyvinyl chloride or polyvinylidene chloride.

6. A building element as claimed in any of claims 1 to 3, wherein said binding agent consists of a synthetic plastics material.

7. A building element as claimed in any preceding claim, wherein said outermost coatings of synthetic plastics material impregnate at least partially said bonded glass fibre layers.

8. A building element as claimed in any one of the preceding claims, wherein said outermost coatings of synthetic plastics material consists of polyethylene, urea resin, melamine resin, epoxy resin or polyester resin.

9. A slab form building element substantially as hereinbefore described with reference to the accompanying drawings.

10. A process for the manufacture of a slab-form building element, comprising the steps of:—

a) distributing on a support surface a comparatively thin and substantially uniform layer of loose, randomly oriented glass fibres.

b) binding the fibres in said glass fibre layer to each other by applying a binding agent onto the layer,

c) pouring upon said bonded glass fibre layer a uniform layer of a mass consisting of an aqueous foam in which cement or plaster and fibrous material is dispersed,

d) applying upon said poured layer and pressing it into the surface of said poured layer a layer of bonded, randomly oriented glass fibres prepared separately in the manner defined by the steps a) and b) above,

e) letting the element dry and harden and removing it subsequently from the support surface, and

f) providing both surfaces of the element with a coating of a synthetic plastics material, as for instance polyethylene, urea resin, melamine resin, epoxy resin or polyester resin.

11. A process as claimed in claim 10, wherein the binding agent used for the glass fibre layers of steps a) and b) and d) respectively consists of a solution or an emulsion of a synthetic plastics material.

12. A process as claimed in claim 10 or 11, wherein the aqueous foam of step c) is prepared from an aqueous emulsion of one or more synthetic water-soluble polymers, such as for instance polyvinyl chloride, polyvinyl acetate, polyvinylidene chloride, polyacrylate, epoxy resin, polyester resin, polyester resin, polystyrene-butadiene or copolymers of said materials.

13. A process as claimed in claim 12, wherein for preparing the mass of step c) a water-polymer-emulsion containing 1 to 10, preferably 2—6% by weight of polymer and about 1% by weight of a wetting agent is used, said emulsion is whipped or stirred into a foam, in which 2 to 20% by weight of an inorganic fibrous material is dispersed, whereafter cement or plaster is added, preferably in an amount producing a final water-cement number of water-plaster number respectively of about 0,5 to 0,6.

14. A process as claimed in any one of claims 10 to 13, wherein the coatings of synthetic plastics material of step f) are produced by applying the synthetic plastics material in a solid state on both surfaces of the element and substantially melting the plastics material.

16. A process for the manufacture of a slab-form building element, substantially as hereinbefore described, with reference to the example given.

HASELTINE, LAKE & CO.,
Chartered Patent Agents,
28, Southampton Buildings,
Chancery Lane, London, W.C.2A 1AT.
Agents for the Applicants.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG. 1

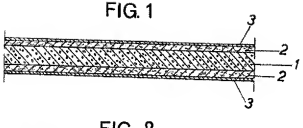

FIG. 2